EXPRESS MAIL LABEL NO.: EL804518588US
DATE: November 8, 2001

JC10 Rec'd PCT/PTO 08 NOV 2001

FORM PTO 1390 (REV 11-2000) U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE		ATTORNEY'S DOCKET NUMBER
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371		LAGROTH -027
		U.S. APPLICATION NO. (If known, see 37 CFR 1.5) 10/009894
INTERNATIONAL APPLICATION NO. PCT/SE00/00940	INTERNATIONAL FILING DATES 11 May 2000	PRIORITY DATE CLAIMED 11 May 1999
TITLE OF INVENTION METHOD AND ARRANGEMENT FOR THE MANUFACTURE OF LIGNOCELLULOSE-CONTAINING BOARDS		
APPLICANT(S) FOR DO/EO/US Göran Lundgren and Göran Oscarsson		

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. [x] This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. [ ] This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing 35 U.S.C. 371
3. [x] This is an express request to begin national examination procedures (35 U.S.C. 371 (f)). The submission must include items (5), (6), (9) and (21) indicated below.
4. [x] The US has been elected by the expiration of 19 months from the priority date (PCT Article 31).
5. [x] A copy of the International Application as filed (35 U.S.C. 371 (c)(2))
   a. [ ] is attached hereto (required only if not communicated by the International Bureau).
   b. [x] has been communicated by the International Bureau.
   c. [ ] is not required, as the application was filed in the United States Receiving Office (RO/US).
6. [ ] An English language translation of the International Application as filed (35 U.S.C. 371 (c)(2)).
   a. [ ] is attached hereto.
   b. [ ] has been previously submitted under 35 U.S.C. 154(d)(4).
7. [x] Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3))
   a. [x] are attached hereto (required only if not communicated by the International Bureau).
   b. [ ] have been communicated by the International Bureau.
   c. [ ] have not been made; however, the time limit for making such amendments has NOT expired.
   d. [ ] have not been made and will not be made.
8. [ ] An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371 (c)(3)).
9. [x] An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)). (Unexecuted)
10. [ ] An English language translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).

Items 11 to 20 below concern document(s) or information included:

11. [ ] An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. [ ] An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. [x] A FIRST preliminary amendment.
14. [ ] A SECOND or SUBSEQUENT preliminary amendment.
15. [x] A substitute specification.
16. [ ] A change of power of attorney and/or address letter.
17. [ ] A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825.
18. [x] A second copy of the published international application under 35 U.S.C. 154(d)(4).
19. [ ] A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).
20. [x] Other items or information: Substitute Abstract, Marked-up Specification, Copy of International Preliminary Examination Report, Four (4) Sheets of Formal Drawings

U.S. APPLICATION NO. (if known, see 37 CFR 1.5)	INTERNATIONAL APPLICATION NO.	ATTORNEY'S DOCKET NUMBER
10/009894	PCT/SE00/00940	LAGROTH-027

21. [X] The following fees are submitted:

CALCULATIONS PTO USE ONLY

BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) – (5)):

[X] Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO $1040.00

[ ] International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO $890.00

[ ] International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO $740.00

[ ] International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) $710.00

[ ] International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) $100.00

ENTER APPROPRIATE BASIC FEE AMOUNT =					$	1,040.00	
Surcharge of $____ for furnishing the oath or declaration later than [ ] 20 [ ] 30 months from the earliest claimed priority date (37 CFR 1.492 (e)).					$		
CLAIMS	**NUMBER FILED**	**NUMBER EXTRA**	**RATE**				
Total claims	*23-20	3	x	18.00	$	54.00	
Independent claims	2-3 =		x		$	0.00	
MULTIPLE DEPENDENT CLAIM(s) (if applicable)			+	280.00	$	280.00	
TOTAL OF ABOVE CALCULATIONS =					$	1,374.00	
[ ] Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by ½.					$		
SUBTOTAL =					$	1,374.00	
Processing fee of $____ for furnishing the English translation later than [ ] 20 [ ] 30 months from the earliest claimed priority date (37 CFR 1.492 (f)). +					$		
TOTAL NATIONAL FEE =					$	1,374.00	
Fee for recording the enclosed assignment (37 CFR 1.21 (h)). Assignment must be accompanied by appropriate cover sheet (37 CFR 3.28, 3.31) + (per property).					$		
TOTAL FEES ENCLOSED =					$	1,374.00	
					Amount to be Refunded:		$
					Charged:		$

*As In Preliminary Amendment

a. [ ] A check in the amount of $____ to cover the above fees is enclosed.

b. [X] Please charge my Deposit Account No. 12-1095 in the amount of $ 1,374.00 to cover the above fees. A duplicate copy of this sheet is enclosed.

c. [X] The Commissioner is hereby authorized to charge any additional fees which may be required or credit any overpayment to my Deposit Account No. 12-1095 . A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137 (a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

LERNER, DAVID, LITTENBERG, KRUMHOLZ & MENTLIK, LLP

600 South Avenue West
Westfield, New Jersey 07090
(908) 518-6304

SIGNATURE:

Arnold H. Krumholz
NAME

25,428
REGISTRATION NUMBER

PATENT
LAGROTH 3.3-027

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of
Göran LUNDGREN *et al.*

International Application No.
PCT/SE00/00940

International Filing Date:
May 11, 2000

For: METHOD AND ARRANGEMENT FOR THE MANUFACTURE OF LIGNOCELLULOSE-CONTAINING BOARDS

Group Art Unit:

Examiner:

Date: November 8, 2001

Commissioner for Patents
Washington, D.C. 20231

PRELIMINARY AMENDMENT

Sir:

Preliminary to initiation of the prosecution of the above-identified pending U.S. patent application, the following amendments and remarks are respectfully submitted.

IN THE ABSTRACT

Please delete the Abstract as filed and substitute therefor the attached revised Abstract.

IN THE SPECIFICATION

Please amend the Specification in accordance with the attached revised Specification.

IN THE CLAIMS

Please cancel claims 1-18 and add new claims 19-38.

19. (NEW) A method of manufacturing boards from lignocellulose-containing material comprising forming said lignocellulose-containing material into a mat, compressing said mat to provide a board having a substantially uniform density, forming a pattern on said board by machining said board to provide a patterned board while retaining said substantially uniform density and pressing said patterned board to form a finished board.

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20. (NEW) The method of claim 19 wherein said forming of said lignocellulose-containing material into said mat includes disintegrating said lignocellulose-containing material into a plurality of particles or fibers and glue-coating said plurality of particles or fibers.

21. (NEW) The method of claim 19 wherein said pressing of said patterned board is carried out while retaining said pattern on said board.

22. (NEW) The method of claim 19 wherein said machining of said board comprises at least one milling step.

23. (NEW) The method of claim 19 including modifying said patterned board prior to said pressing of said patterned board.

24. (NEW) The method of claim 19 including modifying said patterned board during said pressing of said patterned board.

25. (NEW) The method of claim 23 or 24 wherein said modifying of said patterned board comprises applying a sealing surface layer to said patterned board.

26. (NEW) The method of claim 23 or 24 wherein said modifying of said patterned board comprises applying a pre-glued film to said patterned board.

27. (NEW) The method of claim 23 or 24 wherein said modifying of said patterned board comprises applying a laminate to said patterned board.

28. (NEW) The method of claim 19 including applying a further pattern to said patterned board subsequent to said forming of said pattern on said board.

29. (NEW) The method of claim 19 wherein said pressing of said patterned board comprises densifying a surface layer of said patterned board.

30. (NEW) The method of claim 19 wherein said forming of said pattern on said board includes removing a portion of said lignocellulose-containing material and including recycling a portion of said lignocellulose-containing material for use in manufacturing said board.

31. (NEW) Apparatus for manufacturing boards from lignocellulose-containing material comprising a pre-press for compressing a mat of said lignocellulose-containing material to provide a board having a substantially uniform density, at least one cutting machine for forming a pattern on said board so as to provide a patterned board while retaining said substantially uniform density, and a press for pressing said patterned board to form a finished board.

32. (NEW) The apparatus of claim 31 wherein said cutting machine includes at least one milling machine.

33. (NEW) The apparatus of claim 31 including surface layer modifying means for modifying a surface layer of said patterned board.

34. (NEW) The apparatus of claim 33 including laminating means for modifying said patterned board.

35. (NEW) The apparatus of claim 34 wherein said laminating means comprises means for applying reinforcing or sealing material to said patterned board.

36. (NEW) The apparatus of claim 31 wherein said press comprises a continuous press including press elements for contacting said patterned board including a pattern corresponding to said pattern formed by said cutting machine.

37. (NEW) The apparatus of claim 31 including cutting means for cutting said board into a plurality of board lengths, and wherein said press comprises a discontinuous press including press elements for contacting said plurality of board lengths including a pattern corresponding to said pattern formed by said cutting machine.

38. (NEW) The apparatus of claim 31 wherein said press includes densifying means for densifying a surface layer of said patterned board.

REMARKS

The above-noted cancellation of claims 1-18, and addition of new claims 19-38, as well as the submission of a new Abstract and revisions to the Specification, are respectfully

submitted prior to initiation of the prosecution of this application in the U.S. Patent and Trademark Office.

The above-noted new claims are respectfully submitted in order to more clearly and appropriately claim the subject matter which applicants consider to constitute their inventive contribution. No new matter is included in these amendments. In addition, the revisions to the Abstract and Specification are submitted in order to clarify and correct the Abstract and Specification and to conform them to all of the requirements of U.S. practice. No new matter is included in these amendments.

In view of the above, it is respectfully requested that these amendments now be entered, and that prosecution on the merits of this application now be initiated. If, however, for any reason the Examiner does not believe such action can be taken, it is respectfully requested that he telephone applicant's attorney at (908) 654-5000 in order to overcome any objections which he may have.

If there are any additional charges in connection with this requested amendment, the Examiner is authorized to charge applicant's Deposit Account No. 12-1095 therefor.

Respectfully submitted,

LERNER, DAVID, LITTENBERG,
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METHOD AND ARRANGEMENT FOR THE MANUFACTURE OF LIGNOCELLULOSE-CONTAINING BOARDS

FIELD OF THE INVENTION

[0001] The present invention relates to a method of producing boards from lignocellulose-containing material, and to apparatus for carrying out such a method.

BACKGROUND OF THE INVENTION

[0002] Methods of producing boards from lignocellulose-containing raw material are well known in the art, and have found wide use in practice. The manufacture of such boards usually includes the following main method steps: disintegration of the raw material into particles and/or fibers of appropriate size, drying the particles and/or fibers to a predetermined moisture quotient and glue-coating the material either prior to or subsequent to the drying process, shaping the glue-coated material to form a mat, which may comprise several layers, optionally cold-pressing the mat, preheating the mat, water-spraying mat surfaces, etc., and heat-pressing the mat in a discontinuous press or in a continuous press while simultaneously subjecting the material to pressure and heat so as to obtain a finished board. The result will be a board which sometimes includes a thick surface layer with enhanced surface density.

[0003] The boards obtained by this method, e.g. so-called MDF boards (Medium Density Fiberboard) are sometimes used in the production of doors, kitchen cupboard doors, and profiled structural elements such as skirting boards, cornices, window linings, architraving, or furniture components. These structural elements or products are often profiled or patterned, these profiles or patterns being provided in accordance with known technology by milling the profile or pattern into or onto the finished board.

[0004] This method has many drawbacks. For instance, the method involves a production chain and transport chain that consists of many cost-inducing intermediate steps and operations, and which secondly results in a milled product

that will normally have different densities in cross-section, and will therefore absorb different amounts of paint or varnish at different locations, and thirdly milling of the material also results in high material losses. For instance, more than 50% of the starting material can be lost when milling products to pronounced depths.

[0005] Because the board has different densities in the two surface layers subsequent to being worked, the board tends to "warp" when subjected to naturally occurring variations in air humidity.

[0006] In addition, the known methods will normally involve sanding and varnishing, normally with several layers of varnish, or the application of some type of film for priming and/or decorating purposes.

[0007] One object of the present invention is to address these problems. Accordingly, the invention relates to a novel method of avoiding the drawbacks associated with the present-day production process and the many intermediate steps, material transportation and other operations in an economical way.

SUMMARY OF THE INVENTION

[0008] In accordance with the present invention, these and other objects have now been realized by the discovery of a method of manufacturing boards from lignocellulose-containing material comprising forming the lignocellulose-containing material into a mat, compressing the mat to provide a board having a substantially uniform density, forming a pattern on the board by machining the board to provide a patterned board while retaining the substantially uniform density and pressing the patterned board to form a finished board. In a preferred embodiment, the forming of the lignocellulose-containing material into the mat includes disintegrating the lignocellulose-containing material into a plurality of particles or fibers and glue-coating the plurality of particles or fibers.

[0009] In accordance with one embodiment of the method of the present invention, the pressing of the patterned board is carried out while retaining the pattern on the board.

[0010] In accordance with another embodiment of the method of the present invention, the machining of the board comprises at least one milling step.

[0011] In accordance with another embodiment of the method of the present invention, the method includes modifying the patterned board prior to the pressing of the patterned board.

[0012] In accordance with another embodiment of the method of the present invention, the method includes modifying the patterned board during the pressing of the patterned board. Preferably, the modifying of the patterned board comprises applying a sealing surface layer to the patterned board, applying a pre-glued film to the patterned board, or applying a laminate to the patterned board.

[0013] In accordance with another embodiment of the method of the present invention, the method includes applying a further pattern to the patterned board subsequent to the forming of the pattern on the board.

[0014] In accordance with another embodiment of the method of the present invention, the pressing of the patterned board comprises densifying a surface layer of the patterned board.

[0015] In accordance with another embodiment of the method of the present invention, the forming of the pattern on the board includes removing a portion of the lignocellulose-containing material and includes recycling a portion of the lignocellulose-containing material for use in manufacturing the board.

[0016] In accordance with the present invention, apparatus has also been discovered for manufacturing boards from lignocellulose-containing material comprising a pre-press for compressing a mat of the lignocellulose-containing material to provide a board having a substantially uniform density, at least one cutting machine for forming a pattern on the board so as to provide a patterned board while retaining the

substantially uniform density, and a press for pressing the patterned board to form a finished board. In a preferred embodiment, the cutting machine includes at least one milling machine.

[0017] In accordance with one embodiment of the apparatus of the present invention, the apparatus includes surface layer modifying means for modifying a surface layer of the patterned board. Preferably, the apparatus includes laminating means for modifying the patterned board. In a preferred embodiment, the laminating means comprises means for applying reinforcing or sealing material to the patterned board.

[0018] In accordance with another embodiment of the apparatus of the present invention, the press comprises a continuous press including press elements for contacting the patterned board including a pattern corresponding to the pattern formed by the cutting machine.

[0019] In accordance with another embodiment of the apparatus of the present invention, the apparatus includes cutting means for cutting the board into a plurality of board lengths, and wherein the press comprises a discontinuous press including press elements for contacting the plurality of board lengths including a pattern corresponding to the pattern formed by the cutting machine.

[0020] In accordance with another embodiment of the present invention, the press includes densifying means for densifying a surface layer of the patterned board.

[0021] Thus, in accordance with the present invention, a method is provided for subjecting a board between a first step, in which the shaped mat is compressed to a board that has an essentially uniform density, and a second step in which the board is pressed to a finished board, to an intermediate step in the form of at least one machining operation comprising cutting in order to obtain a pattern on or in the board while retaining its generally uniform density. The present invention thus affords the advantage that the machining operation in which a pattern is cut on or in the

board forms part of the production process as an intermediate step prior to finally pressing the board to a finished state. This avoids the expensive transportation and handling operations that are required when the corresponding operation is performed on a finished board.

[0022] One important characteristic feature of the board produced by the present invention is that the board has an essentially uniform density both before and after the machining operation, i.e. a so-called straight density profile, which means that the density is essentially the same across the full cross-section/thickness of the board. The machining and patterning operation thus will not result in any appreciable change in the density of the board. This affords the advantage that the material will be the same across the whole board even after having patterned the board, which simplifies and lowers the cost of subsequent operations, such as painting, varnishing or applying a different material to enhance the mechanical strength of the board or for decoration purposes, among other things. The uniform and unaffected density also has the advantage of reducing the risk of the board warping, by virtue of the fact that the board will absorb moisture uniformly.

[0023] Reference is made to Swedish Patent Nos. 502,272 and 504,221 with respect to the manufacture of uniform density board, these patents describing methods for obtaining boards of uniform density.

[0024] Pressing of the board in the second step of the process is carried out in a manner to retain the pattern obtained by the machining operation and may either be performed in a continuous press or in a batch-wise press, so-called discontinuous press, with hot rolls or press plates that include the intended pattern.

[0025] The boards are preferably machined in one or more milling operations. Other types of mechanical working of the board, however, are conceivable such as sanding or grinding,

for instance. Naturally, a combination of several board machining or working operations may be applied.

[0026] According to one embodiment of the present invention, the surface layer of the board is modified prior to the second process step but after the machining operation.

[0027] According to an alternative embodiment of the present ivneiton, the surface layer of the board is modified in conjunction with the second step.

[0028] Modification of the surface layer of the board may include applying a pre-glued film to the board, or placing a laminate on the board either before pressing the board in the second step or in conjunction therewith, for instance. The film or laminate will then harden firmly to the board, to form a sealing and strengthening layer in the hot pressing operation.

[0029] According to another embodiment of the present invention, a densified surface layer may be produced on the board when pressing the board in the second process step, e.g. in accordance with known technology at high pressures and heat transfer at the beginning of the press cycle.

[0030] These embodiments may, of course, be mutually combined in different ways. All of these embodiments include the possibility of applying a further pattern to the board, such as to give the board a certain surface structure or texture, such as a grain structure or texture.

[0031] Examples of methods of providing a board with a densified surface layer or a sealing surface layer are described in the aforementioned Swedish patent publications.

[0032] The present inventive method also has the advantage of enabling material that is cut away by milling or otherwise removed in the machining operation to be returned to the flow of raw material in the board manufacturing process.

[0033] Finally, the present invention also relates to a corresponding arrangement for carrying out the method hereof comprising an arrangement for carrying out the first step that includes a pre-press in which a mat is compressed to form a

board of generally uniform density, and at least one station which includes a cutting machine for carrying out the intermediate step, and further comprising a press for carrying out the second step.

BRIEF DESCRIPTION OF THE DRAWINGS

[0034] The present invention will now be described in more detail with reference to the exemplifying embodiments set forth in the following detailed description, which, in turn, refers to the accompanying drawings, in which:

[0035] Figure 1 is a side, elevational, schematic view of a board manufacturing method in accordance with a first embodiment of the present invention with continuous pressing of the board;

[0036] Fig. 2a is a side, elevational view of a pattern obtained by means of the method illustrated in Fig. 1;

[0037] Fig. 2b is a side, elevational view of another pattern obtained by means of the method illustrated in Fig. 1;

[0038] Fib. 2c is a top, elevational view of another pattern obtained by means of the method illustrated in Fig. 1;

[0039] Figure 3 is a side, elevational, schematic view of a method for producing boards in accordance with a second embodiment of the present invention with pressing of the board in a discontinuous press;

[0040] Fig. 4a is a top, elevational view of a pattern obtained by milling and stepwise pressing in a discontinuous press; and

[0041] Fig. 4b is a side, elevational, cross-sectional view of the object in Fig. 4a, where the milling operations are illustrated.

DETAILED DESCRIPTION

[0042] The process illustrated in Fig. 1 for the manufacture of boards from lignocellulose-containing material, in accordance with a first embodiment, includes a first process stage in the form of a pre-press 1, an intermediate stage that includes milling stations 2, and a second stage that includes a continuous press 3. Stage one includes a belt

press 1, shown in side view, which typically includes drive rolls 6, stretch rolls 7, guide rolls 8 and an adjustable inlet part 9 that includes infeed rolls (not shown), steam roll 10, and a holding section 12 comprising compression roll and further rolls (not shown), and a surrounding wire 14, or alternatively a perforated steel belt with a wire. The mat 4 fed into the inlet section 9 is compressed to a predetermined density. The glue hardens/cures in the mat in the holder section 12, such as to obtain board that has a uniform density profile. As an example, the density of the board may be from about 150 to 900 kg/m^3, and preferably from about 500 to 700 kg/m^3. A higher density, in the order of from about 800 to 900 kg/m^3, is used in the manufacture of thin boards. In the illustrated case, the holding section 12 is followed by a conditioning unit 16 in which steam and press gases are dealt with.

[0043] After having passed through stage one, the compressed mat 4 is fed into board milling stations 2, in which the pattern desired, in the form of surface patterns, profiled strips or the like, are milled in the board.

[0044] Subsequent to these milling operations, the board is passed into a continuous press 3, which includes the second process stage. The rolls 20 of this press have the same pattern as the milled pattern, so as to ensure that the milled pattern will not be destroyed as the board is pressed. A sealing surface layer can be obtained on the board beneficially in this way. Alternatively, the surface layer of the board can be further reinforced by applying a pre-glued film or a laminate to the machined board prior to the board entering the second press stage. This alternative is illustrated in Fig. 1 with a laminate feed mill 22. The rolls may have a surface temperature of between about 100°C and 300°C, preferably between about 150°C and 250°C.

[0045] Figs. 2a-2c illustrate respective examples of different patterns that can be obtained with the aid of the milling stations in a continuous board pressing process. Figs.

2a and 2b show respective examples of patterns transverse to the longitudinal axis of the board, while Fig. 2c shows an example of a pattern formed in the longitudinal direction of the board. Naturally, many other types of patterns are conceivable within the scope of the present invention.

[0046] The embodiment illustrated in Fig. 3 is concerned with the manufacture of boards in accordance with the present invention, wherein the second stage is comprised of a discontinuous press in which boards that have been cut to length are pressed in a batch-wise manner. Stage 1 is not illustrated in Fig. 3, but may be carried out in the manner illustrated in Fig. 1 or in some other way, for instance in accordance with the aforesaid Swedish patent specifications. The mat 34 compressed to form a board in the first stage is delivered after that stage to a saw 30 that saws the board into board parts of a size suitable for the discontinuous press. After having been sawed to size, the boards are transported to a milling station 32 in which the desired pattern or patterns are milled on the board. Subsequent to the milling process, respective boards are advanced to the discontinuous press 33 and fed thereinto for batch-wise pressing. According to a preferred embodiment of the present invention, a surface layer reinforcing laminate is applied to the board prior to the pressing operation. The laminate is delivered from a laminate feed mill 52. The discontinuous press has press plates that include the intended pattern, i.e. the same pattern as that obtained in the milling operations, so that said pattern will be retained as the board is pressed. Optionally, the board may be given a further pattern, for instance in the form of a surface structure. The press plates will preferably have a surface temperature that lies within the same range as that mentioned with respect to the rolls in the first embodiment illustrated in Fig. 1.

[0047] Finally, Fig. 4a shows an example of a pattern obtained in the plant illustrated in Fig. 3. The object illustrated may be the door of a kitchen cupboard or cabinet,

or a door of some other kind. The door 60 is shown in cross-section in Fig. 4b and in an enlarged view taken on line A-A in Fig. 4a. In the Fig. 4b illustration, a bevelled surface has been milled on the door around its perimeter edge. The door has also been provided with a grooved profile 62 spaced from said outer edge.

[0048] Although the invention herein has been described with reference to particular embodiments, it is to be understood that these embodiments are merely illustrative of the principles and applications of the present invention. It is therefore to be understood that numerous modifications may be made to the illustrative embodiments and that other arrangements may be devised without departing from the spirit and scope of the present invention as defined by the appended claims.

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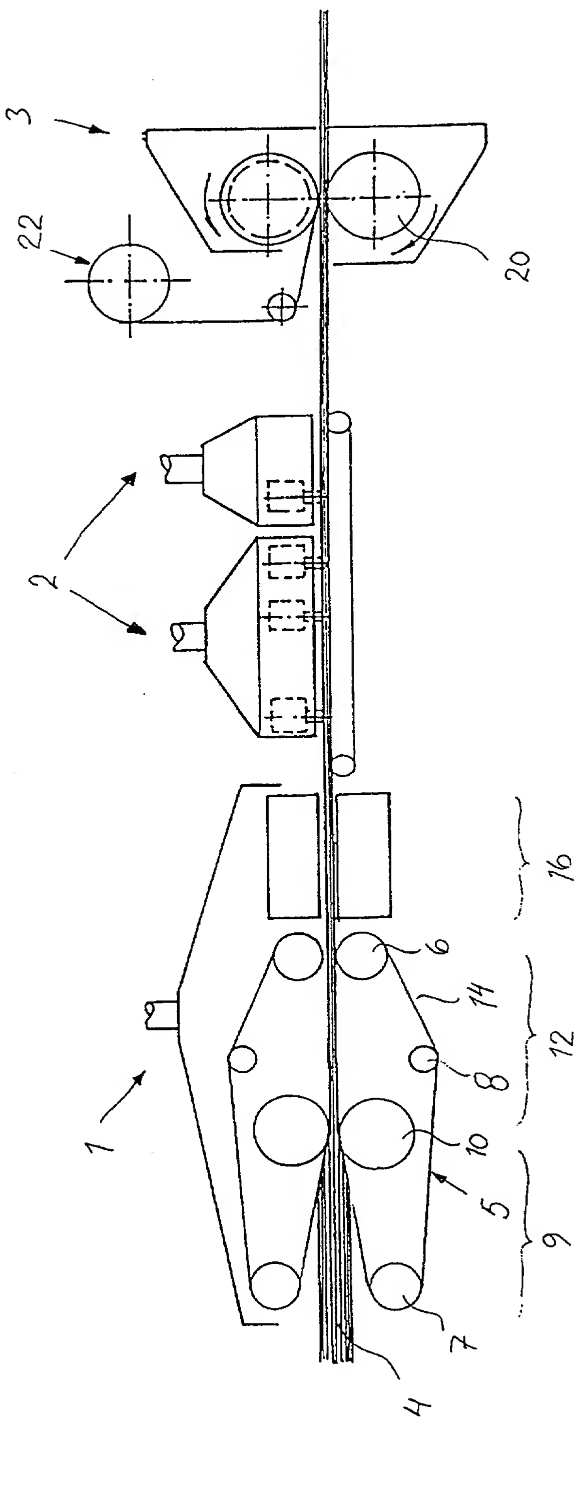

Fig. 1

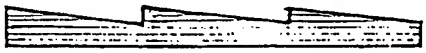

Fig. 2 a

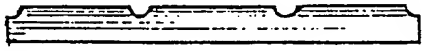

Fig. 2 b

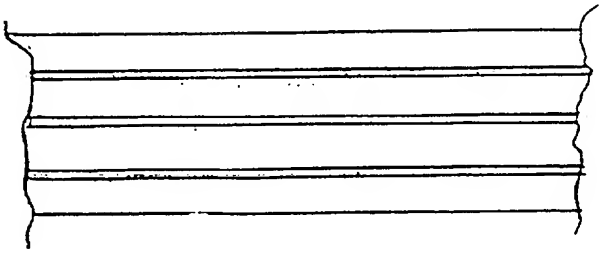

Fig. 2 c

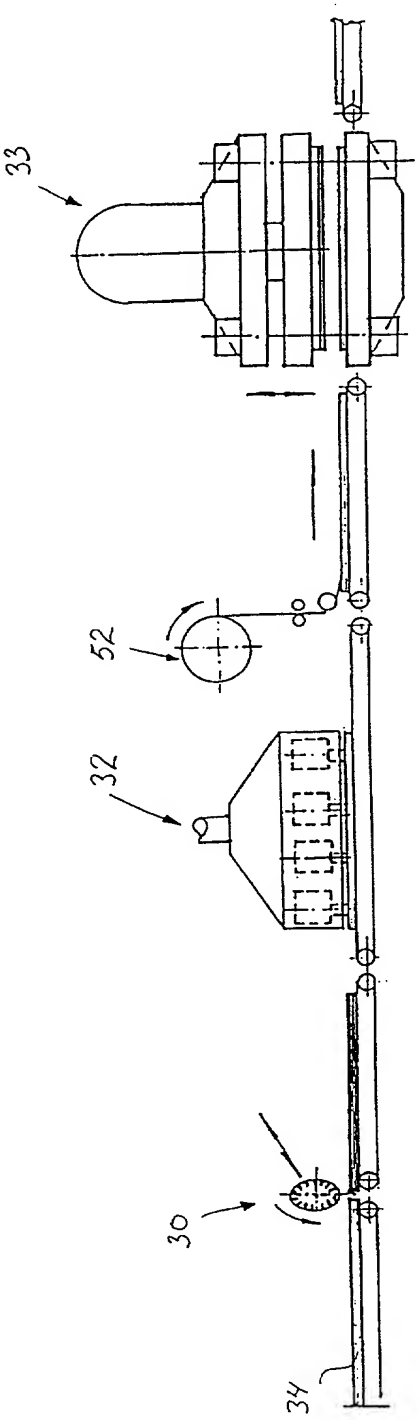

Fig. 3

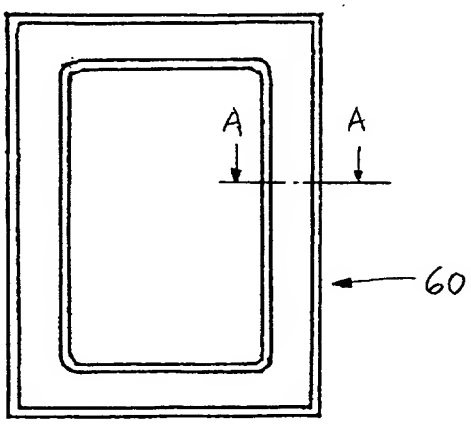

Fig. 4 a

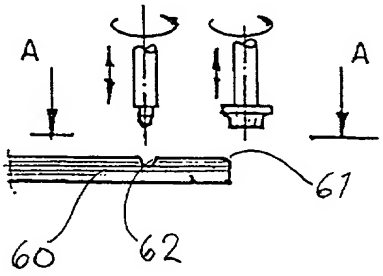

Fig. 4 b

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METHOD AND ARRANGEMENT FOR THE MANUFACTURE OF LIGNOCELLULOSE-CONTAINING BOARDS

FIELD OF THE INVENTION

[0001] The present invention relates to a method of producing boards from lignocellulose-containing material, and to ~~an arrangement~~ apparatus for carrying out ~~the~~ such a method.

BACKGROUND OF THE INVENTION

[0002] Methods of producing boards from lignocellulose-containing raw material are well known ~~to~~ in the art, and have found wide use in practice. The manufacture of such boards usually includes the following main method steps: disintegration of the raw material into particles and/or ~~fibres~~ fibers of appropriate size, drying the particles and/or ~~fibres~~ fibers to a predetermined moisture quotient and glue-coating the material either prior to or subsequent to ~~said~~ the drying process, shaping the glue-coated material to form a mat, which may comprise several layers, optionally cold-pressing the mat, preheating ~~said~~ the mat, water-spraying mat surfaces, etc., and heat-pressing the mat in a discontinuous press or in a continuous press while simultaneously subjecting the material ~~simultaneously~~ to pressure and heat so as to obtain a finished board. The result will be a board ~~with a~~ which sometimes includes a thick surface layer with enhanced surface density.

[0003] The boards obtained by this method, e.g. so-called MDF boards (Medium Density Fiberboard) are sometimes used in the production of doors, kitchen cupboard doors, and profiled structural elements such as skirting boards, cornices, window linings, architraving, or furniture components. These structural elements or products are often profiled or patterned, these profiles or patterns being provided in accordance with known technology by milling ~~said~~ the profile or pattern ~~in/on~~ into or onto the finished board.

[0004] This method has many drawbacks. For instance, the method involves a production chain and transport chain that consists of many cost-inducing intermediate steps and operations, and which secondly results in a milled product that will normally have different densities in cross-section, and ~~therewith~~ will therefore absorb different amounts of paint or varnish at different locations, and thirdly milling of the material also results in high material losses. For instance, more than 50% of the starting material can be lost when milling products to pronounced depths.

[0005] Because the board has different densities in the two surface layers subsequent to being worked, the board tends to "warp" when subjected to naturally occurring variations in air humidity.

[0006] In addition, the known methods will normally involve sanding and varnishing, normally with several layers of varnish, or the application of some type of film for priming and/or decorating purposes.

[0007] ~~The~~ One object of the present invention is to address these problems. Accordingly, the invention relates to a novel method of avoiding the drawbacks associated with the present-day production process and the many intermediate steps, material transportation and other operations in an economical way. ~~The object of the invention is achieved with the method as defined in claim 1 and having the novel characteristic features set forth in the characterising clause of said claim.~~

SUMMARY OF THE INVENTION

[0008] In accordance with the present invention, these and other objects have now been realized by the discovery of a method of manufacturing boards from lignocellulose-containing material comprising forming the lignocellulose-containing material into a mat, compressing the mat to provide a board having a substantially uniform density, forming a pattern on the board by machining the board to provide a patterned board while retaining the substantially uniform density and pressing

the patterned board to form a finished board. In a preferred embodiment, the forming of the lignocellulose-containing material into the mat includes disintegrating the lignocellulose-containing material into a plurality of particles or fibers and glue-coating the plurality of particles or fibers.

[0009] In accordance with one embodiment of the method of the present invention, the pressing of the patterned board is carried out while retaining the pattern on the board.

[0010] In accordance with another embodiment of the method of the present invention, the machining of the board comprises at least one milling step.

[0011] In accordance with another embodiment of the method of the present invention, the method includes modifying the patterned board prior to the pressing of the patterned board.

[0012] In accordance with another embodiment of the method of the present invention, the method includes modifying the patterned board during the pressing of the patterned board. Preferably, the modifying of the patterned board comprises applying a sealing surface layer to the patterned board, applying a pre-glued film to the patterned board, or applying a laminate to the patterned board.

[0013] In accordance with another embodiment of the method of the present invention, the method includes applying a further pattern to the patterned board subsequent to the forming of the pattern on the board.

[0014] In accordance with another embodiment of the method of the present invention, the pressing of the patterned board comprises densifying a surface layer of the patterned board.

[0015] In accordance with another embodiment of the method of the present invention, the forming of the pattern on the board includes removing a portion of the lignocellulose-containing material and includes recycling a portion of the lignocellulose-containing material for use in manufacturing the board.

[0016] In accordance with the present invention, apparatus has also been discovered for manufacturing boards from lignocellulose-containing material comprising a pre-press for compressing a mat of the lignocellulose-containing material to provide a board having a substantially uniform density, at least one cutting machine for forming a pattern on the board so as to provide a patterned board while retaining the substantially uniform density, and a press for pressing the patterned board to form a finished board. In a preferred embodiment, the cutting machine includes at least one milling machine.

[0017] In accordance with one embodiment of the apparatus of the present invention, the apparatus includes surface layer modifying means for modifying a surface layer of the patterned board. Preferably, the apparatus includes laminating means for modifying the patterned board. In a preferred embodiment, the laminating means comprises means for applying reinforcing or sealing material to the patterned board.

[0018] In accordance with another embodiment of the apparatus of the present invention, the press comprises a continuous press including press elements for contacting the patterned board including a pattern corresponding to the pattern formed by the cutting machine.

[0019] In accordance with another embodiment of the apparatus of the present invention, the apparatus includes cutting means for cutting the board into a plurality of board lengths, and wherein the press comprises a discontinuous press including press elements for contacting the plurality of board lengths including a pattern corresponding to the pattern formed by the cutting machine.

[0020] In accordance with another embodiment of the present invention, the press includes densifying means for densifying a surface layer of the patterned board.

[0021] Thus, ~~the inventive method is characterized by~~ in accordance with the present invention, a method is provided for subjecting a board between a first step, in which the

shaped mat is compressed to a board that has an essentially uniform density, and a second step in which the board is pressed to a finished board, to an intermediate step in the form of at least one machining operation ~~of machining by~~ comprising cutting in order to obtain a pattern on or in ~~said~~ the board while retaining ~~the~~ its generally uniform density ~~of said board~~. The present invention thus affords the advantage that the machining operation in which a pattern is cut on or in the board forms part of the production process as an intermediate step prior to finally pressing the board to a finished state. This avoids the expensive transportation and handling operations that are required when the corresponding operation is performed on a finished board.

[0022] One important characteristic feature of the board ~~included in the claim~~ produced by the present invention is that the board ~~shall have~~ has an essentially uniform density both before and after the machining operation, i.e. a so-called straight density profile, which means that the density ~~shall be~~ is essentially the same across the full cross-section/thickness of the board. The machining and patterning operation ~~shall~~ thus will not result in any appreciable change in the density of the board. This affords the advantage that the material will be the same across the whole board even after having patterned the board, which simplifies and lowers the cost of subsequent operations, such as painting, varnishing or applying a different material to enhance the mechanical strength of the board or for decoration purposes, among other things. The uniform and unaffected density also has the advantage of reducing the risk of the board warping, by virtue of the fact that the board will absorb moisture uniformly.

[0023] Reference is made to Swedish ~~Patents SE 502 272 and SE 504 221~~ Patent Nos. 502,272 and 504,221 with respect to the manufacture of uniform density board, these patents ~~publications~~ describing methods for obtaining boards of uniform density.

[0024] Pressing of the board in the second step of the process is carried out in a manner to retain the pattern obtained by the machining operation and may either be performed in a continuous press or in a batch-wise press, so-called discontinuous press, with hot rolls or press plates that include the intended pattern.

[0025] The boards ~~is~~ are preferably machined in one or more milling operations. Other types of mechanical working of the board, however, are conceivable such as sanding or grinding, for instance. Naturally, a combination of several board machining or working operations may be applied.

[0026] According to ~~a first~~ one embodiment of the present invention, the surface layer of the board is modified prior to the second process step but after the machining operation.

[0027] According to an alternative embodiment of the present ivneiton, the surface layer of the board is modified in conjunction with the second step.

[0028] Modification of the surface layer of the board may include applying a pre-glued film to ~~said~~ the board, or placing a laminate on the board either before pressing the board in the second step or in conjunction therewith, for instance. The film or laminate will then harden firmly to the board, to form a sealing and strengthening layer in the hot pressing operation.

[0029] According to another embodiment of the present invention, a densified surface layer may be produced on the board when pressing ~~said~~ the board in the second process step, e.g. in accordance with known technology at high pressures and heat transfer at the beginning of the press cycle.

[0030] These embodiments may, of course, be mutually combined in different ways. All of these embodiments include the possibility of applying a further pattern to the board, such as to give the board a certain surface structure or texture, such as a grain structure or texture.

[0031] Examples of methods of providing a board with a densified surface layer or a sealing surface layer are described in the aforementioned Swedish patent publications.

[0032] The present inventive method also has the advantage of enabling material that is cut away by milling or otherwise removed in the machining operation to be returned to the flow of raw material in the board manufacturing process.

[0033] Finally, the present invention also relates to a corresponding arrangement for carrying out the method~~, in accordance with claim 12,~~ hereof comprising an arrangement for carrying out the first step that includes a pre-press in which a mat is compressed to form a board of generally uniform density, and at least one station which includes a cutting machine for carrying out the intermediate step, and further comprising a press for carrying out the second step.

BRIEF DESCRIPTION OF THE DRAWINGS

~~Other features of the present invention and advantages afforded thereby will be apparent from the depending claims.~~

[0034] The present invention will now be described in more detail with reference to ~~two~~ the exemplifying embodiments ~~thereof illustrated in~~ set forth in the following detailed description, which, in turn, refers to the accompanying drawings, in which:

[0035] Figure 1 is a side, elevational, schematic ~~illustration~~ view of ~~plant and~~ a board manufacturing method in accordance with a first embodiment of the present invention ~~in respect of~~ with continuous pressing of the board;

[0036] ~~Figs.~~ Fig. 2a~~, 2b, 2c show examples of patterns~~ is a side, elevational view of a pattern obtained by means of the method ~~and plant~~ illustrated in Fig. 1;

[0037] Fig. 2b is a side, elevational view of another pattern obtained by means of the method illustrated in Fig. 1;

[0038] Fib. 2c is a top, elevational view of another pattern obtained by means of the method illustrated in Fig. 1;

[0039] Figure 3 ~~illustrates plant and~~ is a side, elevational, schematic view of a method for producing boards

in accordance with a second embodiment of the present invention with ~~respect to~~ pressing of the board in a discontinuous press; ~~and~~

[0040] ~~Figs.~~ Fig. 4a ~~and 4b show examples~~ is a top, elevational view of a pattern obtained by milling and stepwise pressing in a discontinuous press ~~(Fig. 4a),~~ ; and ~~a cross-sectional~~

[0041] Fig. 4b is a side, elevational, cross-sectional view of the object in Fig. 4a, where the milling operations are illustrated ~~(Fig. 4b)~~.

DETAILED DESCRIPTION

[0042] The process illustrated in Fig. 1 for the manufacture of boards from lignocellulose-containing material, in accordance with a first embodiment, includes a first process stage in the form of a pre-press 1, an intermediate stage that includes milling stations 2, and a second stage that includes a continuous press 3. Stage one includes a belt press 1, shown in side view, which ~~includes~~ typically includes drive rolls 6, stretch rolls 7, guide rolls 8 and an adjustable inlet part 9 that includes infeed rolls (not shown), steam roll 10, and a holding section 12 comprising compression roll and further rolls (not shown), and a surrounding wire 14, or alternatively a perforated steel belt with a wire. The mat 4 fed into the inlet section 9 is compressed to a predetermined density. The glue hardens/cures in the mat in the holder section 12, such as to obtain board that has a uniform density profile. As an example, the density of the board may be from about 150- to 900 kg/m^3, and preferably from about 500- to 700 kg/m^3. A higher density, in the order of from about 800- to 900 kg/m^3, is used in the manufacture of thin boards. In the illustrated case, the holding section 12 is followed by a conditioning unit 16 in which steam and press gases are dealt with.

[0043] After having passed through stage one, the compressed mat 4 is fed into board milling stations 2, in

which the pattern desired, in the form of surface patterns, profiled strips or the like, are milled in the board.

[0044] Subsequent to these milling operations, the board is passed into a continuous press 3, which includes the second process stage. The rolls 20 of this press have the same pattern as the milled pattern, so as to ensure that the milled pattern will not be destroyed as the board is pressed. A sealing surface layer can be obtained on the board beneficially in this way. Alternatively, the surface layer of the board can be further reinforced by applying a pre-glued film or a laminate to the machined board prior to the board entering the second press stage. This alternative is illustrated in Fig. 1 with a laminate feed mill 22. The rolls may have a surface temperature of ~~about~~ between about 100°C and 300°C, preferably between about 150°C and 250°C.

[0045] Figs. 2a-2c illustrate respective examples of different patterns that can be obtained with the aid of the milling stations in a continuous board pressing process. Figs. 2a and 2b show respective examples of patterns ~~transversely~~ transverse to the longitudinal axis of the board, while Fig. 2c shows an example of a pattern formed in the longitudinal direction of ~~said~~ the board. Naturally, many other types of patterns are conceivable within the scope of the present invention.

[0046] The embodiment illustrated in Fig. 3 is concerned with the manufacture of boards in accordance with the present invention, wherein the second stage is comprised of a discontinuous press in which boards that have been cut to length are pressed in a batch-wise manner. Stage 1 is not illustrated in Fig. 3, but may be carried out in the manner illustrated in Fig. 1 or in some other way, for instance in accordance with the aforesaid Swedish patent specifications. The mat 34 compressed to form a board in the first stage is delivered after ~~said~~ that stage to a saw 30 that saws the board into board parts of a size suitable for the discontinuous press. After having been ~~sawn~~ sawed to size, the

boards are transported to a milling station 32 in which the desired pattern or patterns are milled on the board. Subsequent to the milling process, respective boards are advanced to the discontinuous press 33 and fed thereinto for batch-wise pressing. According to a preferred embodiment of the present invention, ~~an~~ a surface layer reinforcing laminate is applied to the board prior to ~~said~~ the pressing operation. The laminate is delivered from a laminate feed mill 52. The discontinuous press has press plates that include the intended pattern, i.e. the same pattern as that obtained in the milling operations, so that said pattern will be retained as the board is pressed. Optionally, the board may be given a further pattern, for instance in the form of a surface structure. The press plates will preferably have a surface temperature that lies within the same range as that mentioned with respect to the rolls in the first embodiment illustrated in Fig. 1.

[0047] Finally, Fig. 4a shows an example of a pattern obtained in the plant illustrated in Fig. 3. The object illustrated may be the door of a kitchen cupboard or cabinet, or a door of some other kind. The door 60 is shown in cross-section in Fig. 4b and in an enlarged view taken on ~~the~~ line A-A in Fig. 4a. In the Fig. 4b illustration, a bevelled surface has been milled on the door around its perimeter edge. The door has also been provided with a grooved profile 62 spaced from said outer edge.

~~It will be understood that the invention is not restricted to the aforedescribed exemplifying embodiments thereof, and that these embodiments can be modified and varied in many ways by the person skilled in this art, within the scope of the accompanying claims.~~

[0048] Although the invention herein has been described with reference to particular embodiments, it is to be understood that these embodiments are merely illustrative of the principles and applications of the present invention. It is therefore to be understood that numerous modifications may

be made to the illustrative embodiments and that other arrangements may be devised without departing from the spirit and scope of the present invention as defined by the appended claims.

METHOD AND ARRANGEMENT FOR THE MANUFACTURE OF LIGNO-CELLULOSE-CONTAINING BOARDS

The present invention relates to a method of producing boards from lignocellulose-containing material, and to an arrangement for carrying out the method.

Methods of producing boards from lignocellulose-containing raw material are well known to the art and have found wide use in practice. The manufacture of such boards usually includes the following main method steps: disintegration of the raw material into particles and/or fibres of appropriate size, drying the particles and/or fibres to a determined moisture quotient and glue-coating the material either prior to or subsequent to said drying process, shaping the glue-coated material to form a mat, which may comprise several layers, optionally cold-pressing the mat, preheating said mat, water-spraying mat surfaces, etc., and heat-pressing the mat in a discontinuous press or in a continuous press while subjecting the material simultaneously to pressure and heat so as to obtain a finished board. The result will be a board with a sometimes thick surface layer with enhanced surface density.

The boards obtained by this method, e.g. so-called MDF boards (Medium Density Fiberboard) are sometimes used in the production of doors, kitchen cupboard doors, and profiled structural elements such as skirting boards, cornices, window linings, architraving, or furniture components. These structural elements or products are often profiled or patterned, these profiles or patterns being provided in accordance with known technology by milling said profile or pattern in/on the finished board.

This method has many drawbacks. For instance, the method involves a production chain and transport chain that consists of many cost-inducing intermediate steps and operations, and secondly results in a milled product that will normally have different densities in cross-section and therewith absorb different amounts of paint or varnish at different locations, and thirdly milling of the material also results in high material losses. For instance, more than 50% of the starting material can be lost when milling products to pronounced depths.

Because the board has different densities in the two surface layers subsequent to being worked, the board tends to "warp" when subjected to naturally occurring variations in air humidity.

In addition, the known method will normally involve sanding and varnishing, normally with several layers of varnish, or the application of some type of film for priming and/or decorating purposes.

The object of the present invention is to address these problems. Accordingly, the invention relates to a novel method of avoiding the drawbacks associated with the present-day production process and the many intermediate steps, material transportation and other operations in an economic way. The object of the invention is achieved with the method as defined in claim 1 and having the novel characteristic features set forth in the characterising clause of said claim.

Thus, the inventive method is characterized by subjecting a board between a first step, in which the shaped mat is compressed to a board that has an essentially uniform density, and a second step in which the board is pressed to a finished board, to an intermediate step in the form of at least one operation of machining by cutting in order to obtain a pattern on or in said board while retaining the generally uniform density of said board. The present invention thus affords the advantage that the machining operation in which a pattern is cut on or in the board forms part of the production process as an intermediate step prior to finally pressing the board to a finished state. This avoids the expensive transportation and handling operations that are required when the corresponding operation is performed on a finished board.

One important characteristic feature of the board included in the claim is that the board shall have an essentially uniform density both before and after the machining operation, i.e. a so-called straight density profile, which means that the density shall be essentially the same across the full cross-section/thickness of the board. The machining and patterning operation shall thus not result in any appreciable change in the density of the board. This affords the advantage that the material will be the same across the whole board even after having patterned the board, which simplifies and lowers the cost of subsequent operations, such as painting, varnishing or applying a different material to enhance the mechanical

strength of the board or for decoration purposes, among other things. The uniform and unaffected density also has the advantage of reducing the risk of the board warping, by virtue of the fact that the board will absorb moisture uniformly.

Reference is made to Swedish Patents SE 502 272 and SE 504 221 with respect to the manufacture of uniform density board, these patent publications describing methods for obtaining board of uniform density.

Pressing of the board in the second step of the process is carried out in a manner to retain the pattern obtained by the machining operation and may either be performed in a continuous press or in a batch-wise press, so-called discontinuous press, with hot rolls or press plates that include the intended pattern.

The boards is preferably machined in one or more milling operations. Other types of mechanical working of the board, however, are conceivable such as sanding or grinding, for instance. Naturally, a combination of several board machining or working operations may be applied.

According to a first embodiment, the surface layer of the board is modified prior to the second process step but after the machining operation.

According to an alternative embodiment, the surface layer of the board is modified in conjunction with the second step.

Modification of the surface layer of the board may include applying a preglued film to said board or placing a laminate on the board either before pressing the board in the second step or in conjunction therewith, for instance. The film or laminate will then harden firmly to the board, to form a sealing and strengthening layer in the hot pressing operation.

According to another embodiment, a densified surface layer may be produced on the board when pressing said board in the second process step, e.g. in accordance with known technology at high pressures and heat transfer at the beginning of the press cycle.

These embodiments may, of course, be mutually combined in different ways. All embodiments include the possibility of applying a further pattern to the board, such as to give the board a certain surface structure or texture, such as a grain structure or texture.

Examples of methods of providing board with a densified surface layer or a sealing surface layer are described in the aforementioned Swedish patent publications.

The inventive method also has the advantage of enabling material that is cut away by milling or otherwise removed in the machining operation to be returned to the flow of raw material in the board manufacturing process.

Finally, the present invention also relates to a corresponding arrangement for carrying out the method, in accordance with claim 12, comprising an arrangement for carrying out the first step that includes a pre-press in which a mat is compressed to form a board of generally uniform density, and at least one station which includes a cutting machine for carrying out the intermediate step, and further comprising a press for carrying out the second step.

Other features of the present invention and advantages afforded thereby will be apparent from the depending claims.

The present invention will now be described in more detail with reference to two exemplifying embodiments thereof illustrated in the accompanying drawings, in which

Figure 1 is a schematic illustration of plant and a board manufacturing method in accordance with a first embodiment of the present invention in respect of continuous pressing of the board;

Figs. 2a, 2b, 2c show examples of patterns obtained by means of the method and plant illustrated in Fig. 1;

Figure 3 illustrates plant and a method for producing boards in accordance with a second embodiment of the present invention with respect to pressing of the board in a discontinuous press; and

Figs. 4a and 4b show examples of a pattern obtained by milling and stepwise pressing in a discontinuous press (Fig. 4a), and a cross-sectional view of the object in Fig. 4a where the milling operations are illustrated (Fig. 4b).

The process illustrated in Fig. 1 for the manufacture of boards from lignocellulose-containing material, in accordance with a first embodiment, includes a first process stage in the form of a pre-press 1, an intermediate stage that includes

milling stations 2, and a second stage that includes a continuous press 3. Stage one includes a belt press 1, shown in side view, which includes typically drive rolls 6, stretch rolls 7, guide rolls 8 and an adjustable inlet part 9 that includes infeed rolls (not shown), steam roll 10, and a holding section 12 comprising compression roll and further rolls (not shown), and a surrounding wire 14, or alternatively a perforated steel belt with wire. The mat 4 fed into the inlet section 9 is compressed to a predetermined density. The glue hardens/cures in the mat in the holder section 12, such as to obtain board that has a uniform density profile. As an example, the density of the board may be 150-900 kg/m^3, preferably 500-700 kg/m^3. A higher density, in the order of 800-900 kg/m^3, is used in the manufacture of thin boards. In the illustrated case, the holding section 12 is followed by a conditioning unit 16 in which steam and press gases are dealt with.

After having passed through stage one, the compressed mat 4 is fed into board milling stations 2, in which the pattern desired, in the form of surface patterns, profiled strips or the like, are milled in the board.

Subsequent to these milling operations, the board is passed into a continuous press 3, which includes the second process stage. The rolls 20 of this press have the same pattern as the milled pattern, so as to ensure that the milled pattern will not be destroyed as the board is pressed. A sealing surface layer can be obtained on the board beneficially in this way. Alternatively, the surface layer of the board can be further reinforced by applying a pre-glued film or a laminate to the machined board prior to the board entering the second press stage. This alternative is illustrated in Fig. 1 with a laminate feed mill 22. The rolls may have a surface temperature of about between 100 and 300°C, preferably between 150 and 250°C.

Figs. 2a-2c illustrate respective examples of different patterns that can be obtained with the aid of the milling stations in a continuous board pressing process. Figs. 2a and 2b show respective examples of patterns transversely to the longitudinal axis of the board, while Fig. 2c shows an example of a pattern formed in the longitudinal direction of said board. Naturally, many other types of patterns are conceivable within the scope of the invention.

The embodiment illustrated in Fig. 3 is concerned with the manufacture of boards in accordance with the present invention, wherein the second stage is comprised of a discontinuous press in which boards that have been cut to length are pressed batch-wise. Stage 1 is not illustrated in Fig. 3, but may be carried out in the manner illustrated in Fig. 1 or in some other way, for instance in accordance with the aforesaid Swedish patent specifications. The mat 34 compressed to form a board in the first stage is delivered after said stage to a saw 30 that saws the board into board parts of a size suitable for the discontinuous press. After having been sawn to size, the boards are transported to a milling station 32 in which the desired pattern or patterns are milled on the board. Subsequent to the milling process, respective boards are advanced to the discontinuous press 33 and fed thereinto for batch-wise pressing. According to a preferred embodiment of the invention, an surface layer reinforcing laminate is applied to the board prior to said pressing operation. The laminate is delivered from a laminate feed mill 52. The discontinuous press has press plates that include the intended pattern, i.e. the same pattern as that obtained in the milling operations, so that said pattern will be retained as the board is pressed. Optionally, the board may be given a further pattern, for instance in the form of a surface structure. The press plates will preferably have a surface temperature that lies within the same range as that mentioned with respect to the rolls in the first embodiment illustrated in Fig. 1.

Finally, Fig. 4a shows an example of a pattern obtained in the plant illustrated in Fig. 3. The object illustrated may be the door of a kitchen cupboard or cabinet, or a door of some other kind. The door 60 is shown in cross-section in Fig. 4b and in an enlarged view taken on the line A-A in Fig. 4a. In the Fig. 4b illustration, a bevelled surface has been milled on the door around its perimeter edge. The door has also been provided with a grooved profile 62 spaced from said outer edge.

It will be understood that the invention is not restricted to the aforedescribed exemplifying embodiments thereof, and that these embodiments can be modified and varied in many ways by the person skilled in this art, within the scope of the accompanying claims.

CLAIMS

1. A method of manufacturing boards from lignocellulose-containing material in which the material is disintegrated into particles and/or fibres, glue-coated, and formed into a mat, wherein the formed mat is compressed in a first step to provide board of generally uniform density which is then pressed in a second step to form a finished board, **characterized** by subjecting the board between said first step and said second step to an intermediate step in the form of at least one operation of machining by cutting in which a pattern is formed on or in the board while retaining the essentially uniform density of the board.

2. A method according to claim 1, **characterized** by pressing the board in said second step such as to retain the pattern that was produced by machining said board.

3. A method according to any one of the preceding claims, **characterized** in that said board machining operation includes at least one milling operation.

4. A method according to any one of the preceding claims, **characterized** by modifying the surface layer of the board after said intermediate step and before said second step.

5. A method according to any one of the preceding claims, **characterized** by modifying the surface layer of the board in conjunction with said second step.

6. A method according to any one of claims 4-5, **characterized** in that modification of the surface layer of the board includes the accomplishment of a sealing surface layer on said board.

7. A method according to any one of claims 4-6, **characterized** in that modification of the surface layer of said board includes applying a pre-glued film to said board.

8. A method according to any one of claims 4-6, **characterized** in that modification of the surface layer of said board includes applying a laminate to said board.

9. A method according to any one of the preceding claims, **characterized** by forming a further pattern on the board prior to or in conjunction with said second step.

10. A method according to any one of the preceding claims, **characterized** by densifying the surface layer of the board when pressing said board in the second step.

11. A method according to any one of the preceding claims, **characterized** by returning at least part of the material removed during said machining operation back to the inflow of raw material to the board manufacturing process.

12. An arrangement for carrying out the method according to any one of claims 1-11, comprising an arrangement for carrying out the first step of said method and including a pre-press (1) in which a mat is compressed into a board that has a generally uniform density, at least one station that includes a cutting machine (2; 32) for carrying out the intermediate step of said method, and a press (3; 33) for carrying out the second step of said method.

13. An arrangement according to claim 12, **characterized** in that the cutting machine in said station includes at least one milling machine (2; 32).

14. An arrangement according to any one of claims 12-13, **characterized** by an arrangement (22; 52) for modifying the surface layer of the board subsequent to said intermediate step.

15. An arrangement according to claim 14, **characterized** in that the arrangement (22; 52) for modifying the surface layer of the board after said intermediate step includes means for applying reinforcing and/or sealing material to said board.

16. An arrangement according to any one of claims 12-15, **characterized** in that the press for carrying out the second step of the method is a continuous press (3) whose press elements in contact with the board are provided with the same pattern as that produced in the intermediate step.

17. An arrangement according to any one of claims 12-15, **characterized** in that it also includes means (30) for cutting the board into lengths; and in that the press for carrying out the second step of the method is a discontinuous press (33) whose press elements in contact with the board are provided with the same pattern as that produced in the intermediate step of said method.

18. An arrangement according to any one of claims 12-17, **characterized** in that the press (3; 33) for carrying out the second step of the method also includes means for densifying the surface layer of the board.

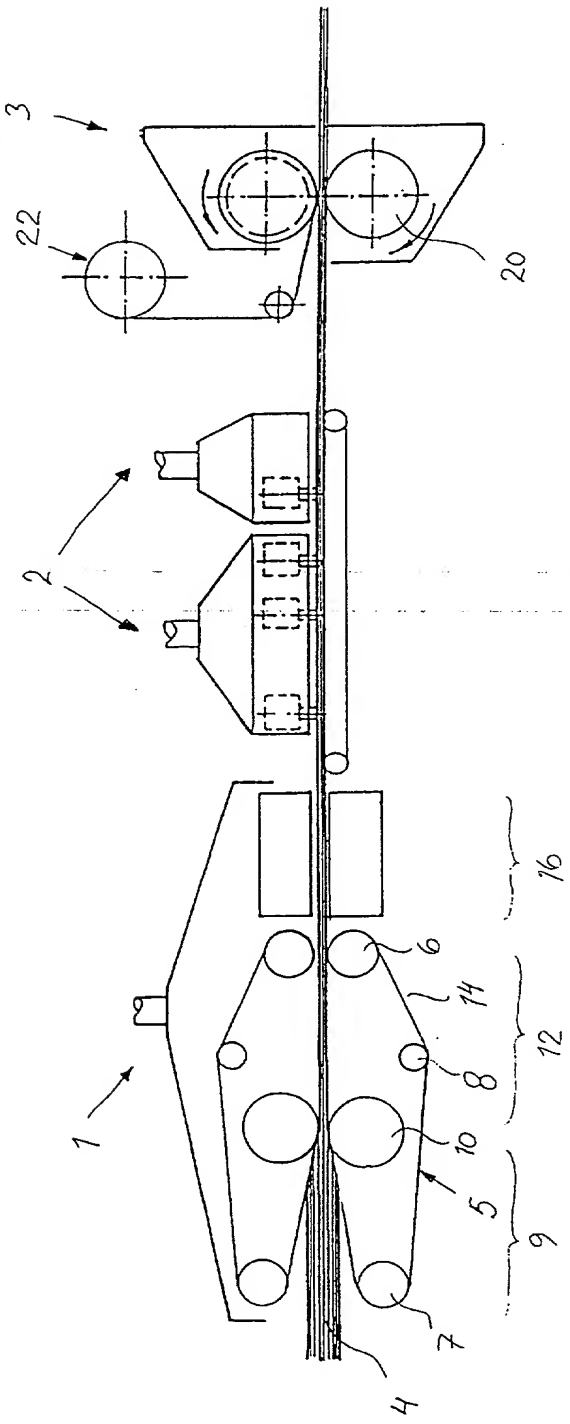

Fig. 1

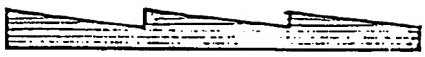

Fig. 2 a

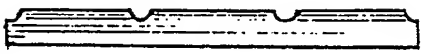

Fig. 2 b

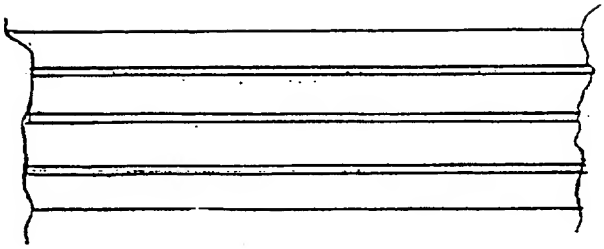

Fig. 2 c

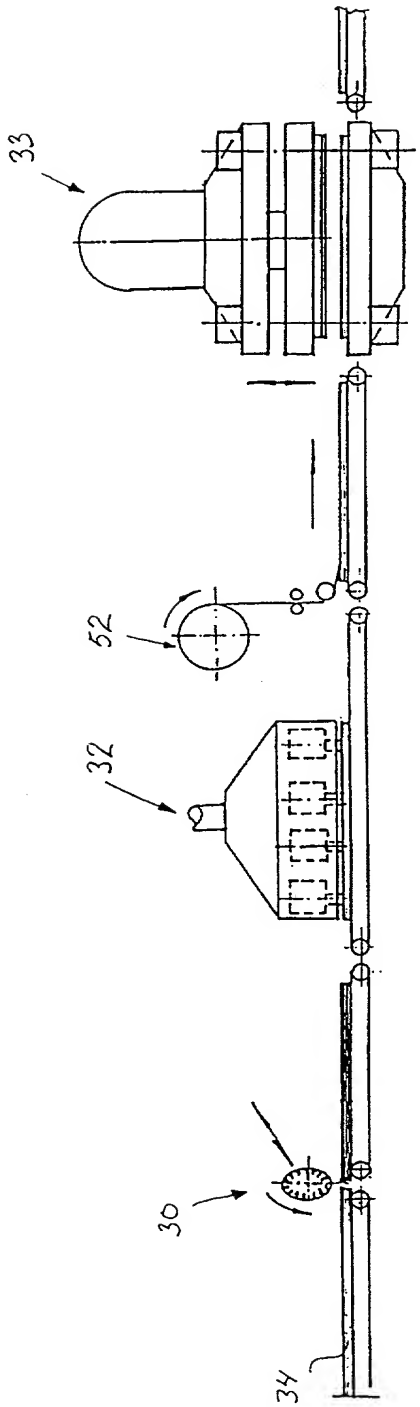

Fig. 3

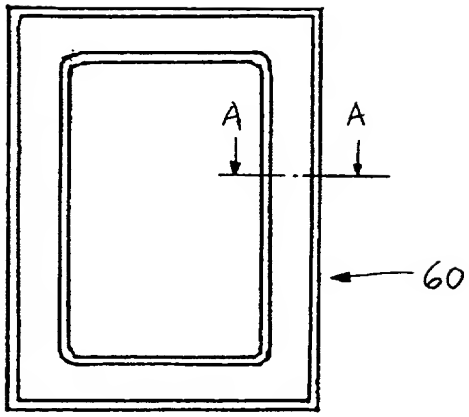

Fig. 4 a

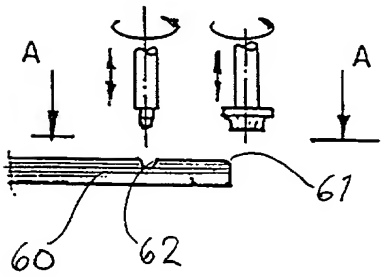

Fig. 4 b

DECLARATION FOR UTILITY OR DESIGN PATENT APPLICATION

ATTORNEY'S DOCKET NO.: LAGROTH-027

As a below-named inventor, I hereby declare that:
My residence, mailing address and citizenship are as stated below next to my name;
I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:
METHOD AND ARRANGEMENT FOR THE MANUFACTURE OF LIGNOCELLULOSE-CONTAINING BOARDS the specification of which

☐ is attached hereto

☒ was filed on May 11, 2000 as United States Application Number or PCT International Application Number PCT/SE00/00940 and was amended on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, § 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, § 119(a)-(d) of any foreign application(s) for patent or inventor's certificate or § 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below any foreign application for patent or inventor's certificate, or any PCT international application having a filing date before that of the application on which priority is claimed:

PRIOR FOREIGN APPLICATION(S)			
COUNTRY	**APPLICATION NUMBER**	**DATE OF FILING (month, day, year)**	**PRIORITY CLAIMED**
SE	9901717-0	May 11, 1999	YES ☒ NO ☐
			YES ☐ NO ☐
			YES ☐ NO ☐
LISTING OF FOREIGN APPLICATIONS CONTINUED ON PAGE 3 HEREOF ☐ YES ☒ NO			

I hereby claim the benefit under Title 35, United States Code, § 119(e) of any United States provisional application(s) listed below:

Application Number: Filing Date:

Application Number: Filing Date:

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s), or § 365(c) of any PCT international application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT international application in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, § 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application:

U.S. Parent Application Serial Number: Parent Filing Date: Parent Patent No.:

U.S. Parent Application Serial Number: Parent Filing Date: Parent Patent No.:

PCT Parent Number: Parent Filing Date:

LISTING OF US APPLICATIONS CONTINUED ON PAGE 3 HEREOF: ☐ YES ☒ NO

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following registered practitioner(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith: Customer Number 000530

DIRECT ALL CORRESPONDENCE TO: Customer No. 000530

DECLARATION -- Page 2

43760 US

ATTORNEY DOCKET NO. _____

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further, that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

1-00

Full name of sole or first inventor (given name, family name): Göran LUNDGREN

Inventor's signature _____ **Date** 8 nov 2001

Residence: Alnö, sweden SEX Citizenship: Swedish

Post Office Address: Metkroksvägen 1, S-865 91 Alnö, Sweden

2-00

Full name of second joint inventor, if any (given name, family name): Göran OSCARSSON

Second Inventor's signature _____ **Date** 22 NOV. 2001

Residence: Lilburn, GA, U.S.A. GA Citizenship: Swedish

Post Office Address: 4141 Oak Terrace, Lilburn, GA, 30047 U.S.A.

Full name of third joint inventor, if any (given name, family name): _____

Third Inventor's signature _____ **Date** _____

Residence: _____ Citizenship: _____

Post Office Address: _____

Full name of fourth joint inventor, if any (given name, family name): _____

Fourth Inventor's signature _____ **Date** _____

Residence: _____ Citizenship: _____

Post Office Address: _____

Full name of fifth joint inventor (given name, family name): _____

Fifth Inventor's signature _____ **Date** _____

Residence: _____ Citizenship: _____

Post Office Address: _____

Full name of sixth joint inventor, if any (given name, family name): _____

Sixth Inventor's signature _____ **Date** _____

Residence: _____ Citizenship: _____

Post Office Address: _____

Full name of seventh joint inventor, if any (given name, family name): _____

Seventh Inventor's signature _____ **Date** _____

Residence: _____ Citizenship: _____

Post Office Address: _____

Full name of eighth joint inventor, if any (given name, family name): _____

Eighth Inventor's signature _____ **Date** _____

Residence: _____ Citizenship: _____

Post Office Address: _____

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